INDIVIDUAL MOVEMENT AND COMMUNICATIONS FIELDS IN RURAL KOREA: A PRELIMINARY EXAMINATION

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PREFACE

The Spatial Diffusion Study was begun in order to provide an intensive examination of the Monte Carlo models of spatial diffusion which were originally proposed by Professor Torsten Hägerstrand of the Department of Geography, Royal University of Lund, Sweden. The major concern of this study lies in the problems which have arisen out of attempts to make the models operational, rather than with their application to specific diffusion situations. Five major problem areas have been identified.

A) Development and use-testing of an efficient computer program for the more complex Hägerstrand models.

B) Sensitivity investigations of the impact of parameter shifts (e.g., variations in barrier effects upon operating results, and of the simulation output.

C) Investigations of the structure of the mean information field (MIF), and the articulation of this concept with existing research on consumer behavior and household travel patterns.

D) Examination of the statistical problems involved in comparison of the two-dimensional distributions which result from the computer simulation with empirical distributions derived from field investigations.

E) Sufficient field testing of the simulation models in significant diffusion situations to demonstrate the capabilities and limitations of the system.

The present report is the twelfth in a series which will present the research findings of the study. The presentation of the material discussed in this report extends the work of the project in problem area C, and presents additional material for work in the problem area E.

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ABSTRACT

This report presents some preliminary findings on the relationship between individual travel behavior and the spatial pattern of interpersonal communications. The empirical studies, based upon field work undertaken in a rural portion of the Republic of Korea during 1967, show that the locations at which person to person communication takes place from a distinct subset of all locations visited in the course of normal household activities. The decay in the number of contacts per unit area with increasing distance from the residence is statistically identical for both sets of stops. Some information on the number of contacts as a function of time of day is also presented.

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The work of Professor Torsten Hägerstrand in the early 1950's has provided the stimulus for most subsequent studies of the spatial diffusion process. The original models proposed by Hägerstrand [1968] included three notions relevant to an explicit spatial formulation: (1) the two-dimensional lattice with evenly spaced lattice points, (2) the mean information field, and (3) the existence of discontinuities between certain of the lattice points. Recent research has generalized the Hägerstrand models to cover irregular lattice structure, but only moderate attention has been given to the latter items [Pitts, 1967; Marble and Bowlby, 1968]. The mean information field (MIF) expresses the decline of the probability of information transfer as a function of increasing distance from the location of the information source. This information field is, then, an example of a spatial autocorrelation function since it defines the dependence of an event (receipt of information) upon conditions as positions surrounding it (number and location of senders of messages). The discontinuities incorporated in the original Hägerstrand models are sharply defined in a spatial

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sense and impose abrupt (and localized) shifts in the character of the distance decay function which defines the information field. In the original Hägerstrand models, these discontinuities usually represented localized physical barriers to movement and communication. The conceptual development of the information field is sketchy at best, and existing empirical work emphasizes our lack of knowledge of this complex function. [Marble and Nystuen, 1963; Morrill and Pitts, 1967; Marble and Bowlby, 1968] The early work by Marble and Nystuen identified the problem of developing direct measures of community information fields and Morrill and Pitts subsequently discussed a number of common measurement surrogates and examined a series of different functional forms relating distance and contact frequency. Marble and Bowlby utilized actual household travel patterns in an urban area to compare social contacts with one of the more commonly utilized surrogates. They concluded that this surrogate measure, marriage distances, tended to overestimate the spatial extent of the information field when compared with the household's pattern of social contacts.

The relationship between the household's information field and its daily, recurrent movement pattern is evident since the former is usually defined as the set of locations at which face-to-face, interpersonal contacts are made, while the latter defines the set of all possible contacts of this nature. Within the spatial point set of trip ends lies a subset constituting the household's information field. The studies mentioned earlier have utilized a variety of surrogates and at least one of these - the spatial pattern of social contacts - would seem to be closely related,

at least intuitively, to the information field. However, the direct relationship between movement fields and communication fields has not, to the best of our knowledge, been the subject of any previous empirical investigation.

The present paper presents some results derived from a pilot study carried out in a rural area of the Republic of Korea during the summer of 1967. The primary goal of the pilot study was to validate recall approaches to the collection of joint movement-communication data in a non-literate culture, and despite the severely restricted sample size, the substantive results are presented at this time because of the complete lack of any other empirical information.

The Field Study

Field studies were carried out near the city of Iri, a town of about 70,000 located on the Cholla Plain in the rice growing area of the Republic of Korea. (see Figure 1) This area was selected because it met the criteria for a low literacy, low mass media impact situation and also because Dr. Seung-Gyu Moon of Chonpuk National University had recently completed a very detailed study for the Agricultural Development Council on innovative behavior of a sample of rural households in the area. Four households in each of three villages located near Iri City (see Figure 2) were selected from those in Dr. Moon's sample. An extensive questionnaire was administered daily to both husbands and wives for a period of eight days. The questionnaire was based upon those used in travel diary studies in the United States with some adaptation for the recall tests and modifications to include the communications items. It had been translated into Korean and field tested near Chonju City.

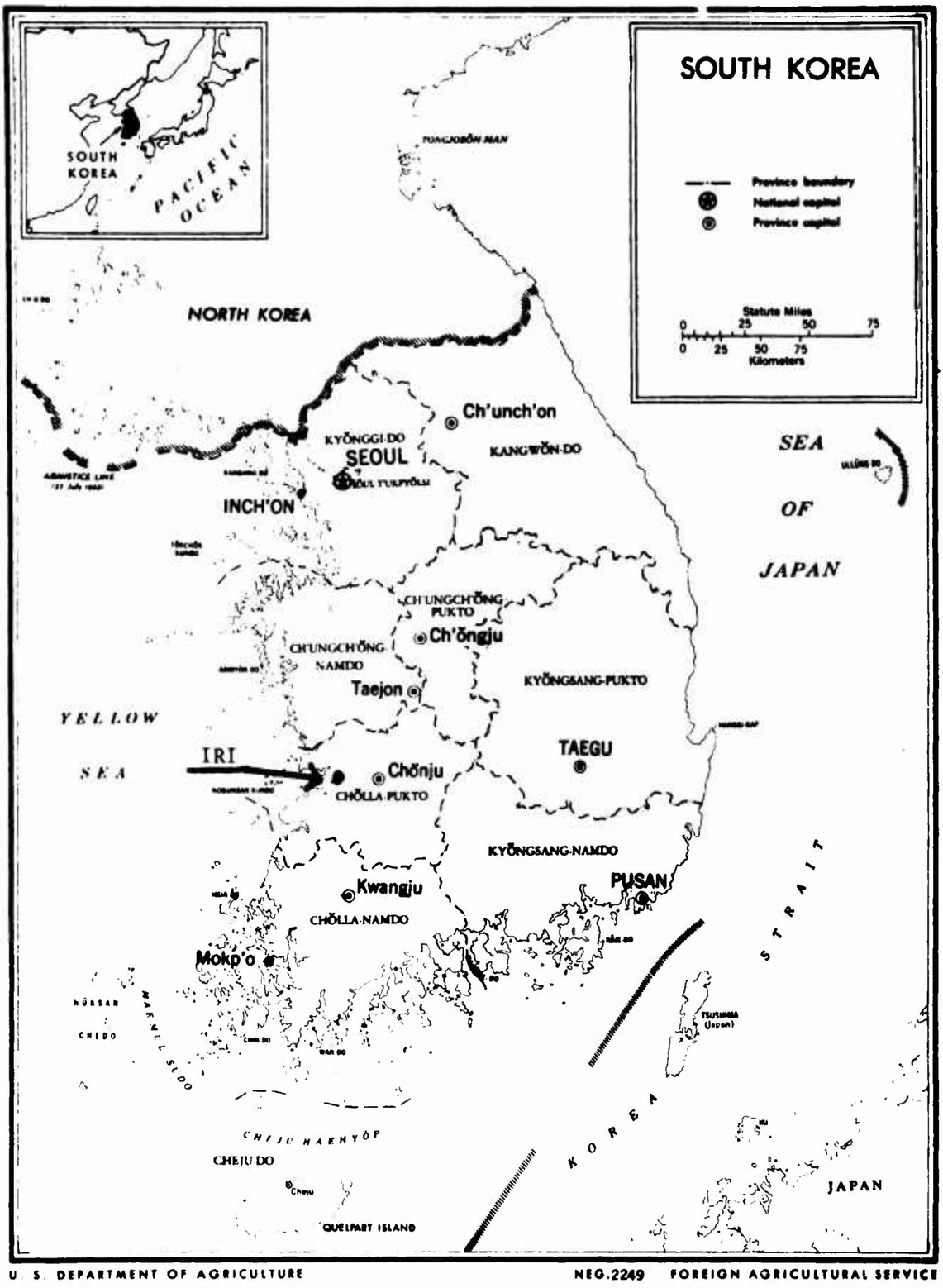

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Figure 1

General Location of the Study Area

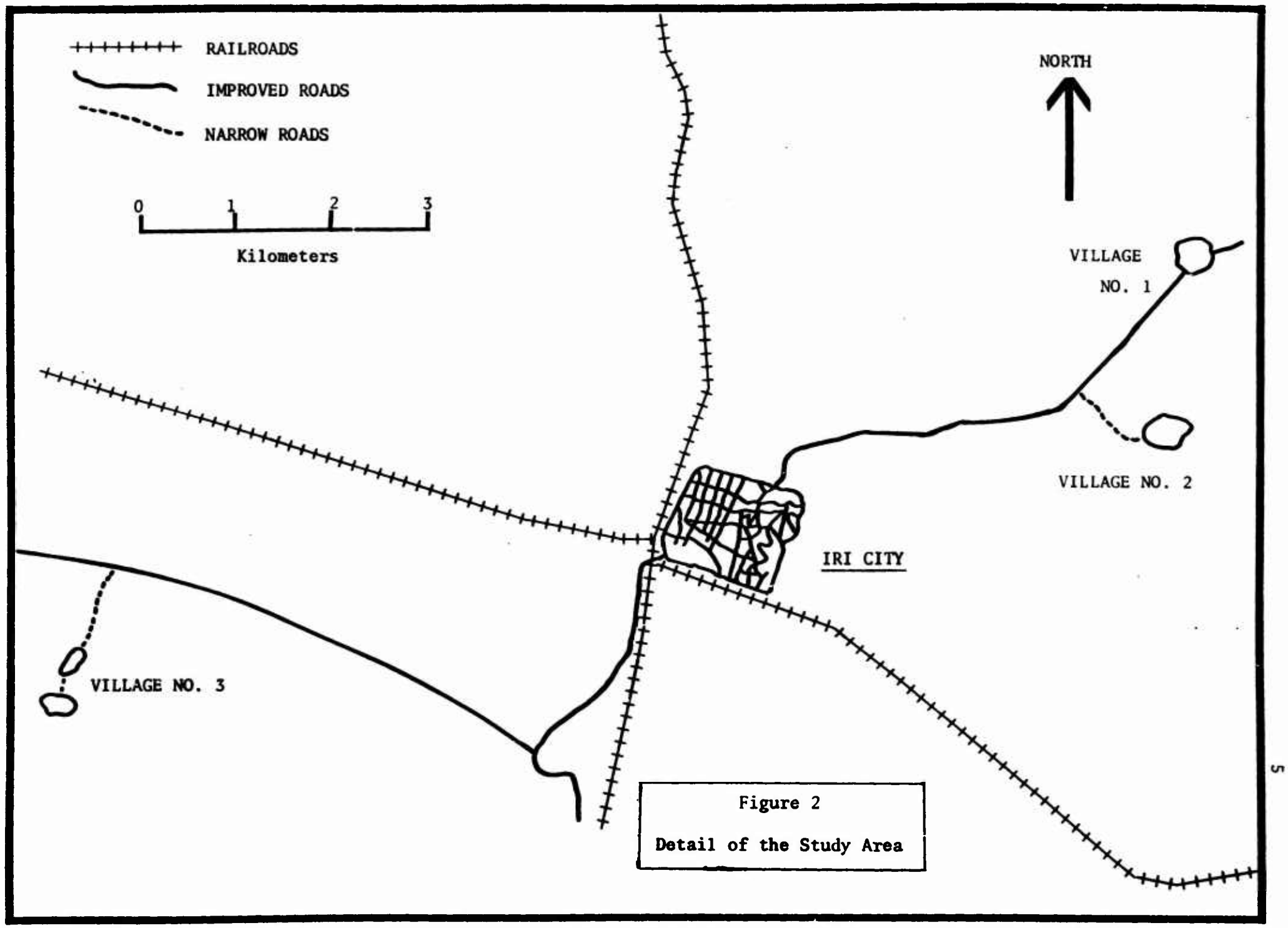


Figure 2

Detail of the Study Area

Information was obtained on a total of more than 1,200 stops made by the twenty-four individuals during the eight day surveillance period. All stops and associated information were locationally coded on the basis of a common plane coordinate system in order to facilitate analysis.

Analysis

Only a coarse spatial analysis has been performed to date. The two-dimensional point patterns representing the locations of the stops with reference to the home as origin were translated to a common origin and filtered to a standard distance decay distribution by making ring counts. The standard approximating function for the resulting frequency distribution is the Pareto which has the form:

$$Y = aD^{b} \qquad (1)$$

which may also be stated in a log linear form:

$$\log Y = \log a + b \log D \qquad (2)$$

The use of standard regression techniques produced the following results:

$$Y_T = 20.18D^{-2.037} \quad (r^2 = .88) \qquad (3)$$

$$Y_C = 15.03D^{-1.93} \quad (r^2 = .88) \qquad (4)$$

where:

Y_T = total number of stops per square kilometer

Y_C = number of communications stops per square kilometer

D = distance in kilometers from the common origin to the midpoint of each ring

The slopes of these two equations are not significantly different from each other, nor from a value of two. The two intercepts do differ significantly at the 95% level. At this lev l of analysis, we conclude that the total number of stops and the number of communication stops decay in an identical manner with increasing distance from the home and that communication stops form a distinctive subset of all stops. This would appear to validate the existing notion that movement fields provide an adequate surrogate for communication fields, and that they may be used as a baseline for the testing of other surrogates.

The Mean Information Field has been, by definition, subject to strong spatial filtering which has removed all directional bias. A second analysis was undertaken to determine if any such bias existed within the two fields examined here. Four 90° sectors were defined with the center of the coordinate system coinciding in turn, with the residence of each individual in each of the three villages. The sectors were then rotated until the centerline of sector one lay along a line drawn from the residence to the center of Iri. This produced a common "toward Iri" sector (sector one), as well as a common "away from Iri" sector (sector three). Ring and sector counts were then made and observations aggregated over all observations in the three villages. Pareto distributions were fitted for each sector with the results as shown in Table I.

Tests were made on each sectorial pair of distributions (total stops vs. communication stops for each sector) and, in all four cases, the hypothesis that there was no significant difference between either the slopes or the intercepts was accepted. This provides additional support for the

Table I

Sector Summaries

	All Stops			Communication Stops		
	a	b	r^2	a	b	r^2
Total Field	20.16	-2.04	0.88	15.03	-1.93	0.88
Sector 1	44.30	-1.79	0.90	35.75	-1.66	0.92
Sector 2	54.89	-1.76	0.81	40.81	-1.65	0.83
Sector 3	34.92	-1.78	0.90	29.67	-1.80	0.92
Sector 4	23.91	-1.94	0.82	20.93	-1.90	0.84

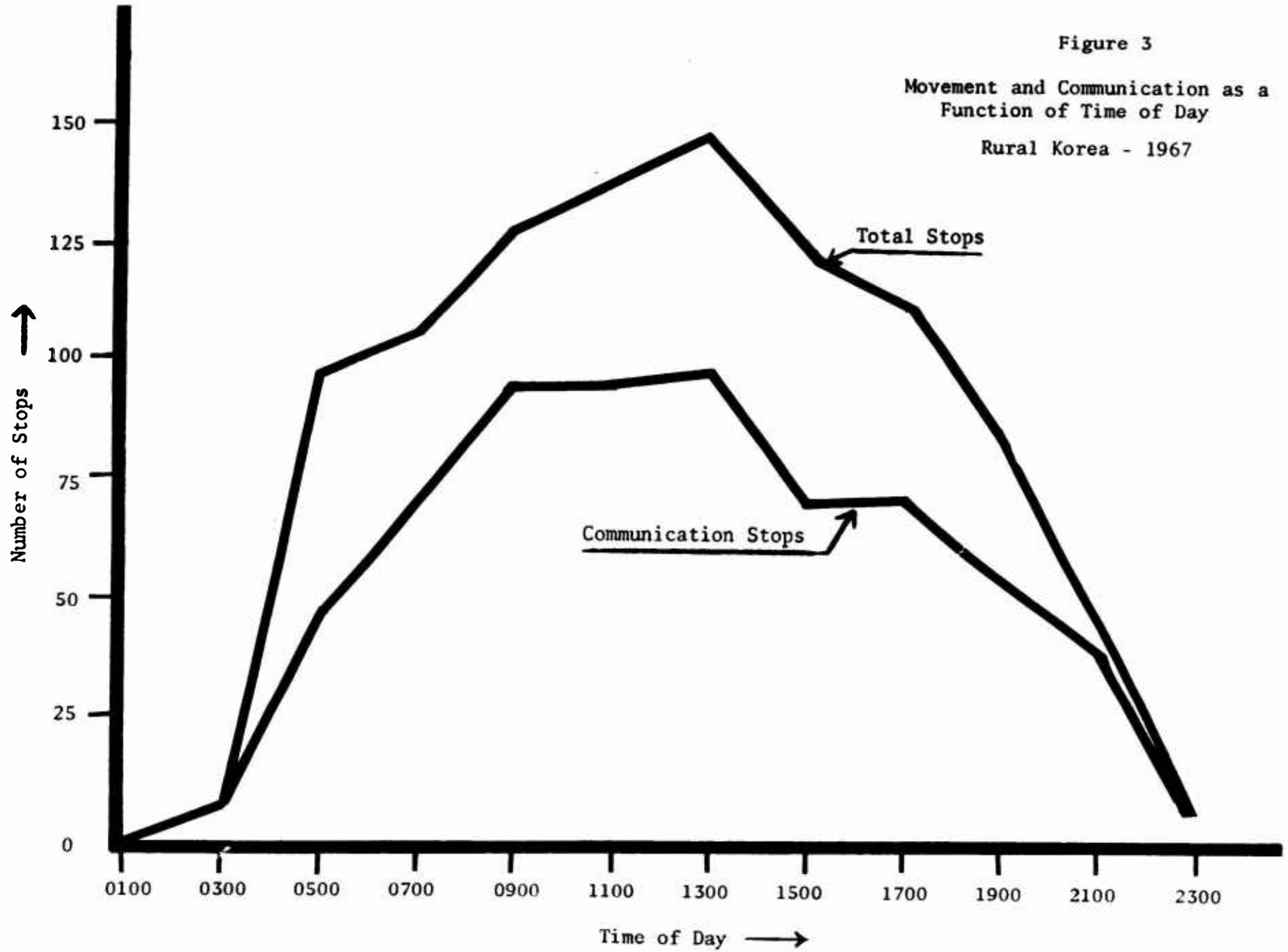
earlier conclusion that movement fields provide a suitable surrogate for communication fields. Tests of the four sectoral slope values for total stops revealed a significant deviation from the overall value of two in three out of four cases. This is indicative of a directional bias in the fields. The bias appears to be related more to topographic variations near the individual villages than to any distorting effect of the city of Iri.

The gross spatial similarity existing between the two fields raises the question of possible temporal similarity as well. Trip generation studies in the U.S. have reported strong seasonal, weekly and diurnal variations in trip making [Garrison and Worrall, 1967]. The Korean surveillance period was too short to permit examination of seasonal or weekly shifts, but Figure 3 displays the diurnal pattern of total stops and communications stops. The proportion of communications stops to total stops shifts during the day, being greatest in the morning and evening hours.

Figure 3

Movement and Communication as a Function of Time of Day

Rural Korea - 1967



This would seem to suggest that the opportunities for communication and perhaps the desire to communicate do not shift in exactly the same fashion as travel needs.

Conclusions

Given the characteristics of the sample, low literacy and little mass media impact, it seems reasonable to conclude that a high degree of similarity exists between movement fields and communication fields and that the former do indeed serve as a viable surrogate for the latter. The extremely small sample size prevents any excursions into the fine structure of these fields (i.e., variations by age, sex, time of day, etc.) and it is certainly not possible to suggest that the gross patterns reported upon here would be characteristic of households in a modern Western city. During the next two years we plan to carry out more extensive studies within both contexts in an effort to provide a greater insight into the relationship between movement and communication behavior in different societies.

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